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ABSTRACT

The effects of math anxiety and sex on computer anxiety, computer confidence, and computer liking were investigated with 161 junior high and high school language arts students; 119 community college mathematics students; and 76 college students residing in dormitories. The Computer Attitude Scale (Loyd and Gressard, 1984) was used to measure attitudes toward learning about and using computers. Each of its three subscales consists of 10 items and presents positively and negatively worded statements such as, "Computers do not scare me at all," with a four-point response scale. Math anxiety was measured with a modified version of the Mathematics Anxiety Scale (Fennema and Sherman, 1976). Results indicate that, after controlling for experience, math anxiety explained a significant addition of variance for computer anxiety, computer confidence, and computer liking. Sex differences were not significant. These findings suggest that schools may need to decentralize their computer activities in order to help counter the association of computers with mathematics; studies of math anxiety may provide insight into computer anxiety; and successful math anxiety treatments may also help to relieve computer anxiety. Six references and six tables are included. (Author/LMM)

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AN INVESTIGATION OF THE EFFECTS OF MATH ANXIETY AND SEX ON COMPUTER ATTITUDES

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An Investigation of the Effects
of Math Anxiety and Sex on Computer Attitudes

This study investigated the effects of math anxiety and sex on computer anxiety, computer confidence, and computer liking for 356 high school and college students. Three hierarchical regression procedures were completed. Results indicated that after controlling for computer experience, math anxiety explained a significant addition of variance for computer anxiety, computer confidence, and computer liking. Sex did not provide a significant addition of information. It was concluded that this study may have implications for determining where computers are introduced into the curriculum and that studies of math anxiety may offer insight into the nature and treatment of computer anxiety.

An Investigation of the Effects of Math Anxiety and Sex on Computer Attitudes

As the acquisition of computer skills becomes increasingly important in our society, students are generally responding positively to the computer courses and experiences to which they are exposed (Lawton and Gerschner, 1982); however, some students have been observed to exhibit varying degrees of anxiety in their attempts to master computer skills.

Historically, computers have been associated with the mathematics curriculum, often to the extent that the learning about and working with computers is considered a "basic" mathematical skill (Jones, 1983). This association has prompted some educators to suggest that "computer anxiety" may be related to math anxiety. Studies of math anxiety (Fennema & Sherman, 1977; Betz, 1978) have shown its prevalence and detrimental effects on the learning of mathematics, especially for females; some educators fear that the learning of computer skills may be adversely affected by a similar anxiety. However, this concern has often been based on anecdotal observations rather than empirical research. The purpose of this study is to investigate the effects of math anxiety and sex on three computer attitudes which have been identified as related to achievement in computer literacy (Jones, 1983): computer anxiety, computer confidence, and computer liking.

Method

Subjects. A total of 356 students participated in the study. Of this total, 161 were junior high and high school students from a large school district, who were enrolled in language arts courses; 119 were community college students who were enrolled in mathematics courses; and 76 were

students at a small liberal arts college who were residing in dormitories; 139 were male and 217 were female. The students selected at each level represented a wide range of backgrounds and academic interests. Previous experience with computers also varied widely within each group. The instruments for this study were administered respectively by the teachers, instructors, and the dormitory residential assistants.

Instruments. Computer attitudes were measured for the study with the Computer Attitude Scale (Loyd & Gressard, 1984), an instrument which measures attitudes toward learning about and using computers. The instrument provides for scores on three subscales: Computer Anxiety, Computer Confidence, and Computer Liking. Each subscale consists of ten items and presents positively and negatively worded statements such as "Computers do not scare me at all" or "Computers make me feel nervous and uncomfortable." Students responded to the statements by selecting one of a set of ordered responses ranging from "strongly agree" to "strongly disagree."

Math anxiety was measured for the study with a modified version of the Mathematics Anxiety Scale (Fennema & Sherman, 1976). This scale consists of ten items and presents positively and negatively worded statements such as "Math does not scare me at all" or "Math makes me feel nervous and uncomfortable." Students responded to the statements by selecting one of a set of ordered responses ranging from "strongly agree" to "strongly disagree." Information on the sex and computer experience of each student was also obtained.

Four scores were computed for each student, one score for each of the scales. Higher scores on the Computer Anxiety subscale correspond to lower anxiety, while higher scores on the Computer Confidence and Computer Liking scales correspond to a greater degree of confidence and liking,

respectively. In general, a higher score corresponds to a more positive attitude toward learning about and working with computers. On the Math Anxiety Scale, higher scores correspond to lower anxiety. In general, a higher score corresponds to a more positive attitude toward the learning of mathematics.

Analysis and Results. Hierarchical regression was used to determine whether addition of information regarding math anxiety and sex accounted for a significant amount of variance of computer attitudes beyond that afforded by differences in computer experience. Three hierarchical regression procedures were completed corresponding to the three subscales of the Computer Attitude Scale. For all analyses, computer experience was entered into the equation first. Computer experience was divided into the following ordered categories: 1 week or less, 1 week to 1 month, 1 month to 6 months, 6 months to 1 year, and 1 year or more. Following computer experience, math anxiety was entered into the equation. Scores ranged from 10 to 60. Sex (male or female) was the final variable to enter the equation. Scores for all three dependent variables (Computer Anxiety, Computer Confidence, and Computer Liking) ranged from 10 to 60. The number of students included in each level of computer experience and sex are presented in Table 2. The correlation coefficients for the independent and the dependent variables are presented in Table 3.

Insert Tables 1, 2, and 3 about here.

The first hierarchical regression procedure used computer anxiety as the dependent variable. The unstandardized regression coefficients (b), and the standardized regression coefficients (B) after entry of all three independent variables into the equation are presented in Table 4. The

multiple correlation (R), the variance explained (R^2), and the change in the variance explained at the entry of each of the three independent variables are also presented in Table 4. Multiple R was significantly different from zero at the end of each step. After step 3, with all independent variables in the equation, the multiple correlation is R=.49,[F(3,352)==36.31, p<.01].

Insert Table 4 about here.

After step 1, with computer experience in the equation, a significant [F(1,354)=54.32, p<.01] amount of variance of computer anxiety was explained (13%). After step 2, with the addition of math anxiety to the equation, there was a significant [F(1,352)=46.30, p<.01] increment (10%) in the total amount of variance explained (24%). After step 3, with the addition of sex to the equation, there was no significant improvement in the total amount of variance explained (24%).

The second hierarchical regression procedure used computer confidence as the dependent variable. The unstandardized regression coefficients (b), and the standardized regression coefficients (B) after entry of all three independent variables into the equation are presented in Table 5. The multiple correlation (R), the variance explained (R^2), and the change in the variance explained at the entry of each of the three independent variables are also presented in Table 5. Multiple R was significantly different from zero at the end of each step. After step 3, with all the independent variables in the equation, the multiple correlation is R=.53, [F(3,352)=45.17, p<.01].

Insert Table 5 about here.

After step 1, with computer experience in the equation, a significant [$F(1,354)=64.04$, $p<.01$] amount of the variance of computer confidence was explained (15%). After step 2, with the addition of math anxiety to the equation, there was a significant [$F(1,352)=58.54$, $p<.01$] increment (12%) in the total amount of variance explained (28%). After step 3, with the addition of sex into the equation, there was no significant improvement in the total amount of variance explained (28%).

The third hierarchical regression procedure used computer liking as the dependent variable. The unstandardized regression coefficient (b) and the standardized regression coefficients (B) after entry of all three independent variables into the equation are presented in Table 6. The multiple correlation (R), the variance explained (R^2), and the change in the variance explained at the entry of each of the three independent variables are also presented in Table 6. Multiple R was significantly different from zero at the end of each step. After step 3, with all independent variables in the equation, the multiple correlation is R=.53, [$F(3,352)=45.92$, $p<.01$].

Insert Table 6 about here.

After step 1, with computer experience in the equation, a significant [($F(1,354)=69.90$, $p<.01$)] amount of the variance of computer liking was explained (16%). After step 2, with the addition of math anxiety to the equation, there was a significant [($F(1,352)=58.54$, $p<.01$)] increment (12%) in the total amount of variance explained (28%). After step 3, with the

addition of sex to the equation, there was no significant improvement in the total variance explained (28%).

Discussion

On all three subscales of the Computer Attitude Scale the average scores were around 45 on a 60-point scale, where a score of 35 would indicate a neutral attitude toward computers. On the Mathematics Anxiety Scale the average score was approximately 41 on a 60-point scale, where a score of 35 would indicate a neutral attitude toward mathematics. In general, the results suggest that the students as a whole had fairly positive attitudes toward computers and mathematics although their attitude toward mathematics was not as positive as their attitudes toward computers.

Computer experience was found to account for a small but significant amount of the variance of the three computer attitudes (computer anxiety, computer confidence, and computer liking). The correlations between computer experience and computer attitudes were moderate and positive for this sample, indicating more computer experience corresponding to more positive computer attitudes.

With the addition of math anxiety into the regression equation, the variance accounted for of all three computer attitudes was significantly increased. The correlations between math anxiety and computer attitudes were moderate and positive for this sample, indicating less math anxiety corresponding to more positive computer attitudes.

Sex was not found to increase significantly the explained variance of any of the three computer attitudes. Correlations between sex and computer attitudes were found to be nearly zero for this sample, indicating sex and computer attitudes to be fairly independent. This finding lends support to a study of ninth grade students (Jones, 1983) in which no sex differences were found for computer anxiety, computer confidence, and computer liking.

The results of these two studies may lessen the concern expressed by educators that the pattern of sex differences in mathematical achievement created by sex differences in affective variables will be repeated in regard to achievement in computer literacy.

This study does suggest, however, that math anxiety may be a small but important factor in the high computer anxiety and low computer confidence and/or liking of some high school and college students. Although it is not clear from the statistical analysis how math anxiety contributes to computer anxiety, the results of the study suggest that schools may need to consider the "decentralization" of their computer activities in order to counter to some extent the association of computers with mathematics. The results also suggest that studies of math anxiety may provide insight into computer anxiety, and techniques that have been successful in the treatment of math anxiety may also help to relieve computer anxiety.

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Table 1

Means and Standard Deviations for
Computer Anxiety, Computer Confidence, Computer Liking,
and Math Anxiety

Variable	Mean	Standard Deviation
Computer anxiety	46.03	9.05
Computer confidence	43.46	10.10
Computer liking	44.34	10.41
Math anxiety	40.99	11.50

Table 2

Frequencies for Sex and Computer Experience

Sex	N
Males	139
Females	217
Computer Experience	
1 week or less	117
1 week to 1 month	43
1 month to 6 months	105
6 months to 1 year	29
1 year or more	62

Table 3

Correlation Coefficients

	Computer Experience	Math Anxiety	Sex
Math anxiety	.17		
Sex	.00	-.09	
Computer anxiety	.36	.39	-.05
Computer confidence	.39	.41	-.05
Computer liking	.41	.41	-.04

Table 4

Summary for Regression of Computer Anxiety on Computer Experience, Math Anxiety, and Sex

Variable	Regression Coefficient b	Standardized Coefficient B	Multiple Correlation R	Variance Explained R^2	Change in R^2
Computer experience	1.93**	.31	.36**	.13	.13**
Math anxiety	.25**	.32	.49**	.24	.10**
Sex	-.40	-.02	.49**	.24	.00

**p<.01

Table 5

Summary for Regression of Computer Confidence on Computer Experience, Math Anxiety, and Sex

Variable	Regression Coefficient b	Standardized Coefficient B	Multiple Correlation R	Variance Explained R^2	Change in R^2
Computer experience	2.30**	.33	.39**	.15	.15**
Math anxiety	.31**	.36	.53**	.28	.12**
Sex	-.35	-.02	.53**	.28	.00

**p<.01

Table 6

Summary for Regression of Computer Liking on Computer Experience, Math Anxiety, and Sex

Variable	Regression Coefficient b	Standardized Coefficient B	Multiple Correlation R	Variance Explained R^2	Change in R^2
Computer experience	2.49**	.35	.41**	.16	.16**
Math anxiety	.31**	.35	.53**	.28	.12**
Sex	-.09	-.00	.53**	.28	.00

**p<.01